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Development of geocoronal Hydrogen Lyman Alpha Imaging CAmera (LAICA)

SATO, Masaki[1*] ; KAMEDA, Shingo[1] ; YOSHIKAWA, Ichiro[2] ; TAGUCHI, Makoto[1] ; FUNASE, Ryu[2] ; KAWAKATSU, Yasuhiro[3]

[1]Rikkyo University, [2]University of Tokyo, [3]JAXA

Hydrogen and helium atoms are the main constituents of the outermost region of the earth's atmosphere. These atoms resonantly scatter solar ultraviolet radiation causing an ultraviolet glow in this region, called geocorona. Hydrogen Lyman alpha radiation (121.567 nm) is the brightest. To date, various observations of the geocorona have been made. The geocorona comprises three main particle populations: ballistic, escaping, and satellite. Escaping particles are present at all altitudes, and they become particularly dominant at higher altitudes. In previous observations, the geocorona was identified to extend to an altitude of about 20R_E. The geocoronal distribution reveals asymmetries from day to night, dawn to dusk, and north to south. Recently, abrupt temporary increases (from 6% to 17%) in the total number of hydrogen atoms in the spherical shell from a geocentric distance of 3R_E to 8R_E have been recorded during several observed geomagnetic storms.

Past exploration of the geocorona has mainly been obtained from earth orbiters. Therefore, several low altitude (˜8R_E) observations have been made. On the other hand, in order to obtain the geocoronal distribution at high altitude, it is necessary to observe the geocorona from the outside in. However, there have been very few such observations (only Mariner 5, Apollo 16, and Nozomi). Among them, only Apollo 16 obtained an image. However, the observational FOV was about 10R_E.

In this study, we are developing a LAICA (geocoronal hydrogen Lyman Alpha Imaging CAmera) which will go onboard the very small deep space explorer PROCYON that will escape the earth and navigate interplanetary space. From such an explorer, our equipment can perform wide FOV (more than 25R_E) imaging of the geocoronal distribution. The first observation will be conducted one week after the launch for a period of one or two weeks. Subsequently, observations will continue for about three months. These observations will be conducted in higher temporal resolutions than that obtained from earth orbiters. The prototype of the LAICA has now been manufactured for testing and verification. And the flight model will have been completed by May. This presentation will show the development status.

Keywords: geocorona, Lyman alpha line, exosphere, earth's atmosphere